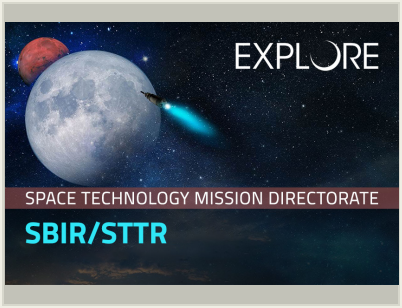
Multi-Sensor Ensemble Aerosol Assimilation - CERES, MODIS and VIIRS, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

Accurate estimates of the radiative effects of clouds and aerosols are essential for an understanding of the Earth's climate system. Under the EOS program, NASA has placed into orbit a series of satellites devoted to long term observations of the climate state. Central to the observation of the radiation balance are the CERES instruments that fly on both the Terra (2000-present) and Aqua (2002-present) platforms, each in tandem with a MODIS imager. Another CERES instrument has been launched (late 2011) upon the Suomi NPP satellite along with the MODIS successor, VIIRS. The CERES mission depends on an aerosol assimilation system to augment information from MODIS-based aerosol inversions and allow for the creation of datasets such as surface radiative fluxes. This project will enhance the existing CERES aerosol assimilation system in several ways. (1) We will construct assimilation functionality for VIIRS aerosols, merged MODIS and VIIRS aerosols and potentially aerosol retrievals from other instruments. (2) To facilitate multi-sensor data assimilation we will create an IDL toolkit, SatelliteDL, for the analysis of satellite Earth observations from a diverse set of platforms and sensors. The design will feature an abstraction layer that allows for easy inclusion of new datasets in a modular way. The core function of the toolkit will be the spatial and temporal alignment of satellite swath and geostationary data. (3) We will construct an ensemble Kalman filter aerosol assimilation system. This will allow for robust statistical uncertainty estimates in aerosol quantities of importance to the radiative forcing of the climate. Two recent advances have made such an approach possible. First, the MODIS mission has quantified aerosol retrieval uncertainties based on extensive comparisons to surface measurements, and second, the international AeroCom collaboration has established the feasibility of generating aerosol ensembles based on statistical model emulation.



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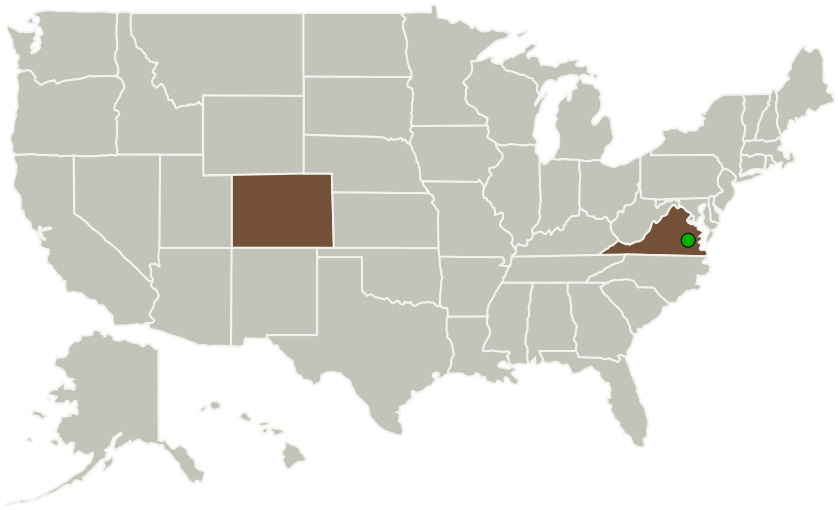
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Tech-X Corporation	Lead Organization	Industry	Boulder, Colorado
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Colorado	Virginia

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140608)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Tech-X Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

David W Fillmore

Co-Investigator:

David Fillmore

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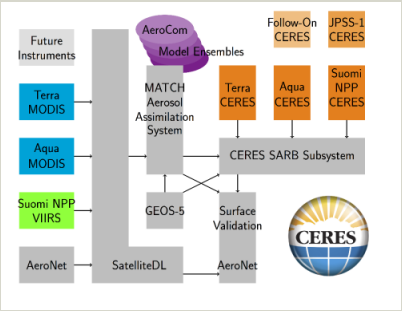
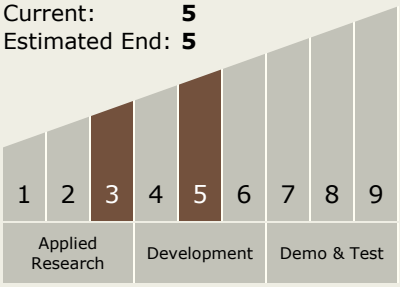
Images



Briefing Chart
Multi-Sensor Ensemble Aerosol Assimilation - CERES, MODIS and VIIRS, Phase I
(https://techport.nasa.gov/image/136503)

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.1 Field and Particle Detectors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System